Spatial Analysis of Poor Households in East Java Using Geographically Weighted Regression Method

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A B S T R A C T

Food demand progressively increasing along with population growth and the decline in productivity of agricultural land due to impact increasing need for housing. This condition is exacerbated by a lack of accurate data related to factors that affect poverty in each region in East Java. In order to maintain economic and social stability in East Java, this research will analyze variables that affect poverty by methods Geographically Weighted Regression (GWR). From the research that analyze eleven variables has been founded seven variables that significantly influence poverty in East Java

Key words: Food demand, population growth, poverty, variable

INTRODUCTION

Problems of proverty is still a serious agenda that need to be faced and addressed the Government of East Java. Poverty is a phenomenon of spatial heterogeneity, which is usually indicated by the poor tendency to cluster at a particular region [1]. Geographical variation of poverty and the level poverty is often caused by factors with spatial dimensions, such as natural resources, access to health care, education, housing and others [2].

The results of the national socio-economic survey by the Central Bureau of Statistics (BPS) in 2007 and 2010 showed that the poor in East Java from year to year has increased, it is not separated from the magnitude of the poverty line are donated from each region [3]. The poverty line is the price paid by the reference group to meet the food needs of 2,100 kcal/capita/day and other needs such as housing, clothing, health, education, transport and others [4].

Referring from the research above, many researchers the search for solutions to addressing poverty, both from the point of view of the social, economic, health and science. [5] in his research using the achievement of food security indicators as a measure of the degree of poverty. The indicators are divided into two groups, namely the process and impact indicators.

Process indicators describe the food situation addressed by the availability and access to food, while the impact indicators include direct and indirect indicators.[6] identified poverty indicators are

Always related to agricultural production, access to natural resources, land management practices, the development of institutions, markets, regional conflicts and social unrest. [7] examines poverty from the aspects of household food security level. Food security is mainly determined by the economic value of rice, because rice is the most important commodity in Indonesia, especially for lower socio-economic groups. Thus the level of

rice prices is the main determinant of poverty at the household level. [8] in their research they are discuss the concept of poverty indicators in accordance with the character of SMEs and SME current conditions in an effort to alleviate poverty in Indonesia and help achieve the MDGs by exploiting the existence of Small and Medium Enterprises (SMEs) that have been the backbone of the supply labor in Indonesia.

In line with the thinking [9], [10] and [11] observed that poverty variables focused on the economic aspects rather than social, cultural, legal and even religious. Where the results of this study found significant variables and estimates could result in outcomes that do not fit in the alleviation of poverty. The problem occurs because in determining the poverty variables have not understood comprehensively based on the reality that exists and happens in Indonesia.

In this research, analysis of spatial data used to determine the poor households in East Java with respect to geographical factors of each district/city. Spatial data analysis results can be used to map out the conditions of poverty in each district/city. In addition, the results of this study can be used as indicators and evaluation addressing poverty in East Java.

2.0 Literature Review:

Model geographically weighted regression (GWR) is a development of the regression model, where each parameter is calculated at each observation location. every location has a parameter value regression observation different. At this GWR model of the geographical factor are predictor variables that can affect the response variable. Assumptions used GWR models are normally distributed error with *mean* nol dan varians σ^2 [1]:

$$y_i = \beta_0\left(u_i, v_i\right) + \sum_{k=1}^{p} \beta_k\left(u_i, v_i\right) x_{ik} + \varepsilon_i \tag{1}$$

with :

y_i : the value of the response variable in location to-i

$\left(u_i, v_i\right)$: geographical location coordinates (*longitude*, *latitude*) from the location of the observation to- i

$\beta_k\left(u_i, v_i\right)$: Regression coefficient predictor variables to-k on the location of the observation to-i

x_{ik} : The value of the predictor variables observation to-k on the location of the observation to-i

ε_i : Error observations to - i are assumed to be identical , independent and normally distributed with zero mean and constant variance σ^2.

Distribution Y_i is :

$$Y_i \sim N\left(\beta_0\left(u_i, v_i\right) + \sum_{k=1}^{p} \beta_k\left(u_i, v_i\right) X_{ki}, \sigma^2\left(u_i, v_i\right) \right) \tag{2}$$

3.0 Methodology:

Research methodology can be seen as the techniques used to collected and analyze data. The data collected have to be related to the objective and problem statement. There are four types of methods that used in this study to obtain the relevant data which are literature review, interview, identification of variable research and make of regional map of poverty.

3.1 Literature Review:

Literature review includes studies of spatial analysis, modeling GWR and analysis poverty in Indonesia.

3.2 Interview:

Interviews are used of validation the data research. Source of data obtainable from head of the Central Bureau of Statistics (BPS) and the Agency for Community Empowerment (BAPEMAS) East Java Province in 2012. There are several indicators used to assess the problem of poverty in East Java, one of them by using the indicator Warning System on Food and Nutrition (FNS) of the Department of Health. Indicators of poverty includes a variable percentage of poor population, the percentage of malnourished children under five, the

percentage of under-five deaths and widespread damage to crops. This indicator is more appropriate if placed in agricultural areas such as in Indonesia. Based on data SUSENAS : Nutrition Map of Indonesia and health information data in East Java in 2012. which contains the provincial health profile [12]. Where it is known that the proportion of food-insecure people in all provinces in Indonesia still on top 10%.

   The unit of observation in this study was 38 regencies in East Java.

3.4 Variable of Research:

   Variables used in this study include the percentage of poor households as the response variable. While the predictor variables include the number of residents (soul), population density (soul/km^2), the average life expectancy of children, the percentage of under-five deaths, the number of severely malnourished infants, toddlers get a percentage of complete immunization, the percentage of access to clean water, sanitation percentage ownership basic (toilets), the number public healthy center, healthy homes percentage, the percentage of households receiving rice for poor households and percentage of per capita expenditure less than Rp.300.000,-. For variable factors include the geographic latitude and longitude.

3.5 Regional Mapping Of Poverty:

   Mapping the characteristics of poverty based on the significant variables in each city/county.

RESULTS AND DISCUSSION

4.1 Description of Data:

   Information a research data, the distribution pattern of the data obtained population data and population density in each regency/city as follows:
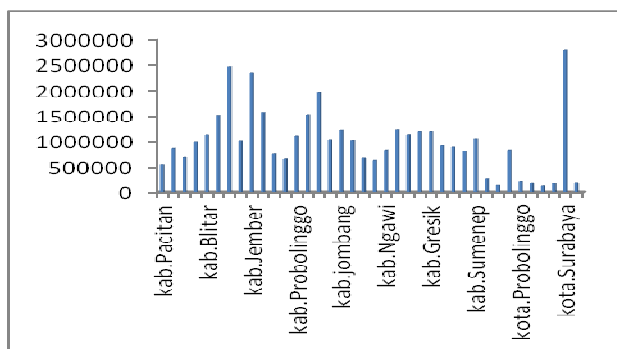

Fig. 1: Data on the number and population density of East Java.

   Figure 1 showed that the most populous city in East Java is in Surabaya (2781047 person), Malang (2459982 person), Jember (2345851 person) and Sidoarjo (1952421 person). This condition occurs because the region is an area of potential industrial urbanization targeted villagers who are not educated and have specialized expertise. The impact of high population density has caused some social problems such as unemployment, crime and poverty in the region. Another impact of this poverty is the inability to meet the housing needs of the community. As information is known that the average percentage of home ownership in East Java healthy until 2012 was still low (28.86%). Figure 2 showed the percentage of healthy homes in East Java
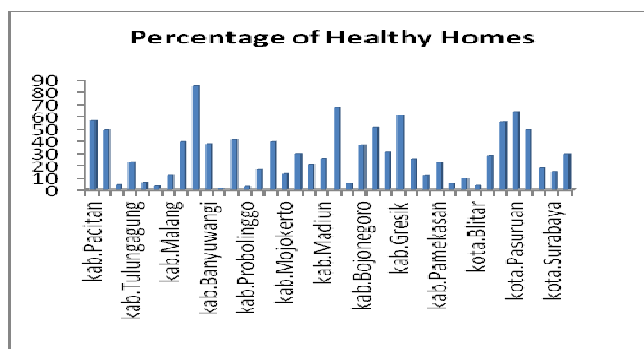

Fig. 2: Percentage of healthy homes in East Java.

Addition to indicators of the percentage of healthy, then the ownership of basic sanitation is also an indicator of poor households. Figure 3 shows the ownership percentage of basic sanitation.
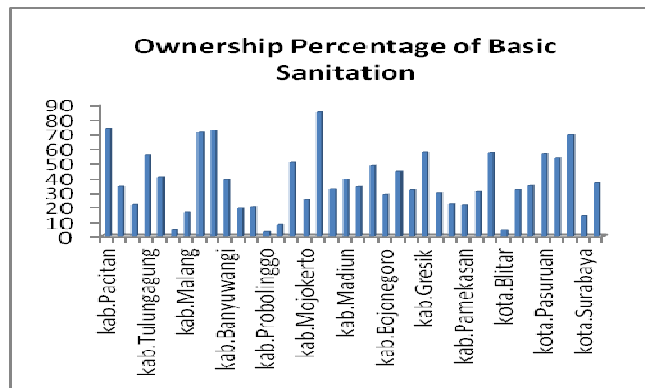

Fig. 3: Ownership percentage of basic sanitation.

East Java public awareness of the importance of having basic sanitation was still low, it is common in people who are educated and low economy. They tend to use basic sanitation river for subsistence (bathing, washing and toilet facilities).

Indicators of poor haousehold receiveng rice is also ane important variable in determining poor hosehold in East java (Figure 4). Result of data analysis obtained an average percentage of poor households remins high rice beneficiaries (61.36%).
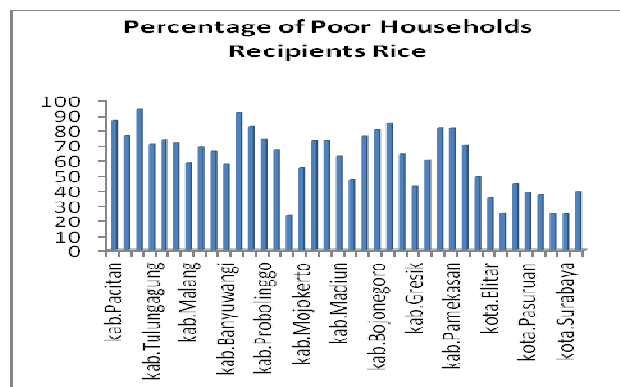

Fig. 4: Percentage of Poor Households Recipients Rice.

Other indicators are used to determine the percentage of poor households are households per capita expenditure below Rp.300.000,- (Figure 5).
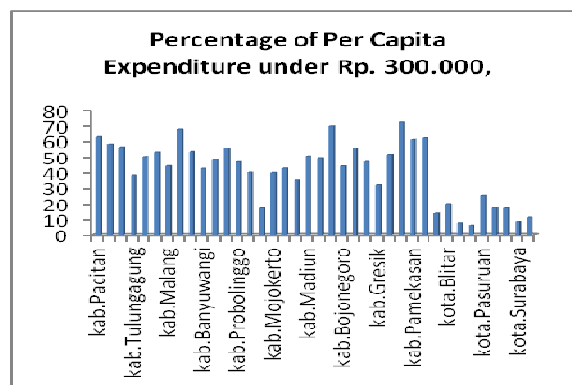

Fig. 5: Percentage of Per Capita Expenditure under Rp.300.000, in East Java.

Results of data analysis showed that the average percentage of per capita household expenditure under Rp.300.000, - still high (41 495%). This shows that the level of income of the people of East Java is still low. This condition needs to be a serious concern for the government to create jobs is evenly distributed in each region. Under the influence of the above variables showed that the percentage of poor households in East Java are still high (15.9632%). This is evident from the data distribution (Figure 6) in each district/city in East Java.
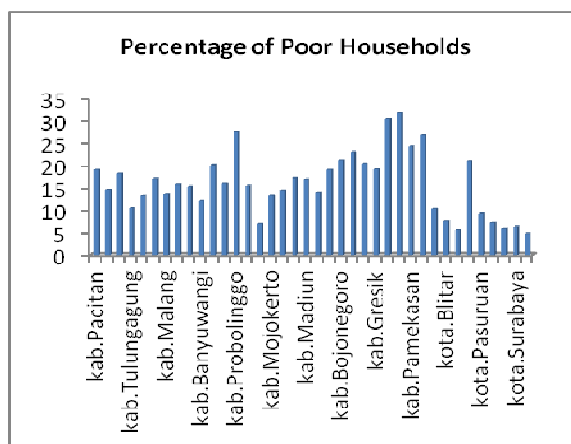

Fig. 6: Percentage of Poor Households in East Java.

4.2 Analysis of Data:

To determine the condition of any varibles that significantly affect the percentage of poor households, it first has to find a analysis of variance (ANOVA). Results of ANOVA regression model (Table 1) F-test statistics values obtained for the percentage of poor households with a 6.24 and p-value 0%. By using a significance level of 5%, it can be concluded that the predictor variables simultaneously significant effect on poor households in East Java.

Table 1: ANOVA Poor Households in East Java.

Sources	Degrees of Freedom	Sum of Squares	Mean Squares	F	p- value
Regression	11	26.840	2.440	6.24	0.00
Error	26	10.160	0.391		
Total	37	37.000			

ANOVA results of the regression model above (Table 1), it still shows that all predictor variables globally influential to the formation of poor households in East Java. To find out which areas are significantly influenced predictor variables, then the modeling study conducted by GWR models.

From the analysis of the program GWR 4 (Table 2) obtained the best model for determining the percentage of poor people in East Java is to use the weighted Gaussian fixed with optimum bandwidth are 5.721279 and CV are 30.091553.

Table 2: Appropriation test Model GWR using quality of Fixed Gaussian.

Sources	Degrees of Freedom	Sum of Squares	Mean Squares	F
Global Residual	11	487.455	26.369	1.46241
GWR	26	58.992	18.031	
Total	37			

GWR models conformance testing done by finding the difference between the residual sum of squares and GWR models of global regression residuals. Results Table 2 shows that the residual sum of squares model of GWR (58.99) is smaller than the residual sum of squares of regression models (487.455). By using a significance level of 5%, showed that GWR models better than the global regression model or in other words more appropriate GWR models used to describe the condition of poor households in East Java.

To determine what predictor variables have a significant effect in each district/city, it can be used to test the effect of partial geographic factors for each predictor variable (Table 3) significan at $\alpha = 5\%$.

Of the results in Table 3 obtained value of F test on variable X_1, X_2, X_3, X_4, X_6, X_8, X_{10} and X_{11} greater than the F table. It can be seen from the results DOF smaller than the significance level of 5% or Diff of Criterion is negative.

Table 3 Partial Test predictor variables with Gaussian weighting Fixed

Variable	Local Parameter		
	F	DOF	Diff of Criterion
Intercept	1.254622	0.120	0.42543
X_1	42.808207	0.098	-49.268550
X_2	45.808597	0.025	-66.945083
X_3	6.071803	0.030	-0.230750
X_4	4.070679	0.020	-0.038702
X_5	1.708198	0.130	0.369443
X_6	3.039453	0.052	-0.091742
X_7	0.724739	0.043	0.188825
X_8	12.724491	0.027	-1.718288
X_9	2.113340	0.034	0.076747
X_{10}	6.930629	0.030	-0.157032
X_{11}	6.167881	0.077	-0.304158

By using a significance level of 5% is obtained locally influential variable in each district/city is the population (the soul) (X_1), population density (soul/km^2) (X_2), the average life expectancy of children (X_3), percentage of under-five mortality (X_4), toddlers get a percentage of complete immunization (X_6), number public healthy center (X_8), the percentage of households receiving rice for poor households (X10) and the percentage of per capita expenditure less than Rp.300.000, - (X_{11}).

Based on the results of Table 3, then look for a map of the spatial distribution of the percentage of poor households in East Java (Figure 7).

Fig. 7: Spatial maps of the percentage of poor households in East Java.

In Figure 7. We divided into 4 groups of districts/cities with poverty levels as follows :
1. Percentage of poor households is less than 10% covering the town of Madiun, Blitar, Malang, Mojokerto, Surabaya, Sidoarjo and Banyuwangi.
2. Percentage of poor households covering 10-15% Magetan, Ponorogo, Tulungagung, Jombang, Mojolerto, Malang, Bangkalan, Jember and Batu.
3. Percentage of poor households covering 15-20% Ngawi, Madiun, Nganjuk, Pacitan, Trenggalek, Gresik, Pasuruan, Lumajang, Situbondo, Bondowoso, Kediri and Pasuruan.
4. Percentage of poor households covering more than 20% Bojonegoro, Tuban, Lamongan, Kediri, Blitar, Probolinggo, Sampang, Pamekasan, Sumenep and the city of Probolinggo.

Conclusion:

Based on the above discussion, it can be concluded that the results of the identification model of spatial map obtained by the method of GWR 4 conditions of poor households in East Java by geographical factors of each distric/city. The results of this research can be further used as indicators and evaluation materials handling poor households in East Java suit the real conditions in each district/city.

ACKNOWLEDGEMENT

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